feeding oxygen gas and a small quantity of $N_2$ gas for increasing generation efficiency of ozone into an ozone generator connected to the process vessel, and generating a process gas containing ozone in the ozone generator;

supplying the process gas from the ozone generator into the process vessel;

exciting the process gas by a gas exciting system provided on the process vessel, thereby generating active oxygen atoms from the process gas; and

exposing the metal oxide film to the active oxygen atoms to modify the metal oxide film.

58. (New) The method of Claim 57, wherein the gas exciting system comprises a system selected from a group consisting of:

a heating system,

a plasma generating system, and

a UV radiating system.

59. (New) The method of Claim 58, wherein the plasma generating system uses power selected from a group consisting of:

microwave power, and

high-frequency power.

60. (New) The method of Claim 58, wherein the UV radiating system comprises a lamp selected from a group consisting of:

a mercury-sealed lamp, and

an excimer lamp.

61. (New) The method of Claim 57, wherein:

the excimer lamp is set to emit UV rays having a wavelength of 180 nm or less.

62. (New) The method of Claim 57, wherein:

a small quantity of $H_2$ gas is fed along with the $N_2$ gas into the ozone generator when the process gas is generated.

63. (New) The method of Claim 57, wherein:

a pressure in the process vessel is set to fall in a range of 0.1 to 600 Torr when the metal oxide film is modified.

64. (New) The method of Claim 57, wherein:

a temperature of the target process object is set to fall in a range of 320°C to 700°C when the metal oxide film is modified.

65. (New) The method of Claim 57, wherein:

a pressure in the process vessel is set to fall in a range of 0.1 to 50 Torr when the metal oxide film is modified.

66. (New) The method of Claim 65, wherein:

a temperature of the target process object is set to fall in a range of 400°C to 700°C when the metal oxide film is modified.

67. (New) The method of Claim 57, wherein the metal oxide film consists essentially of a material selected from a group consisting of:

tantalum oxide,

titanium oxide,

zirconium oxide,

barium oxide,

strontium oxide,

niobium oxide,

hafnium oxide,

yttrium oxide, and

lead oxide.

68. (New) The method of Claim 67, wherein the metal oxide film consists essentially of a material selected from a group consisting of:

tantalum oxide, and

hafnium oxide.

69. (New) A method of modifying a metal oxide film formed on a surface of a target process object, the method comprising:

loading the target process object including the metal oxide film formed thereon into a process vessel;

feeding oxygen gas and a small quantity of $N_2$ gas for increasing generation efficiency of ozone into an ozone generator connected to the process vessel, and generating a process gas containing ozone in the ozone generator;

supplying the process gas from the ozone generator into the process vessel;

exciting the process gas, thereby generating active oxygen atoms from the process gas, while heating an interior of the process vessel by a heater through a worktable on which the target process object is placed; and

exposing the metal oxide film to the active oxygen atoms to modify the metal oxide film.

70. (New) The method of Claim 69, wherein a small quantity of $H_2$ gas is fed along with the $N_2$ gas into the ozone generator when the process gas is generated.

71. (New) The method of Claim 69, wherein:

a pressure in the process vessel is set to fall in a range of 0.1 to 600 Torr when the metal oxide film is modified.

72. (New) The method of Claim 69, wherein:

a temperature of the target process object is set to fall in a range of 320°C to 700°C when the metal oxide film is modified.

73. (New) The method of Claim 69, wherein:

a pressure in the process vessel is set to fall in a range of 0.1 to 50 Torr when the metal oxide film is modified.

74. (New) A method according to claim 73, wherein:

a temperature of the target process object is set to fall in a range of 400°C to 700°C when the metal oxide film is modified.

75. (New) The method of Claim 69, wherein the metal oxide film consists essentially of a material selected from a group consisting of:

tantalum oxide,

titanium oxide,

zirconium oxide,

barium oxide,

strontium oxide,

niobium oxide,

hafnium oxide,

yttrium oxide, and

lead oxide.

76. (New) The method of Claim 75, wherein the metal oxide film consists essentially of a material selected from a group consisting of:

tantalum oxide, and

hafnium oxide.

77. (New) A method of modifying a metal oxide film formed on a surface of a target process object, the method comprising:

loading the target process object including the metal oxide film formed thereon into a process vessel;

supplying the process gas containing oxygen atoms into the process vessel;

exciting the process gas by irradiating the process gas with UV rays emitted from an excimer lamp provided on the process vessel, thereby generating active oxygen atoms from the process gas; and

exposing the metal oxide film to the active oxygen atoms to modify the metal oxide film.

78. (New) The method of Claim 77, wherein:

the excimer lamp is set to emit UV rays having a wavelength of 180 nm or less.

79. (New) The method of Claim 77, wherein:

a pressure in the process vessel is set to fall in a range of 0.1 to 600 Torr when the metal oxide film is modified.

80. (New) The method of Claim 77, wherein:

a temperature of the target process object is set to fall in a range of 320°C to 700°C when the metal oxide film is modified.

81. (New) The method of Claim 77, wherein:

a pressure in the process vessel is set to fall in a range of 0.1 to 50 Torr when the metal oxide film is modified.

82. (New) The method of Claim 81, wherein: